SBS in Photonic Crystal Fibers

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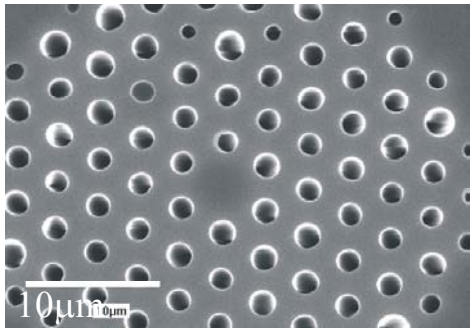
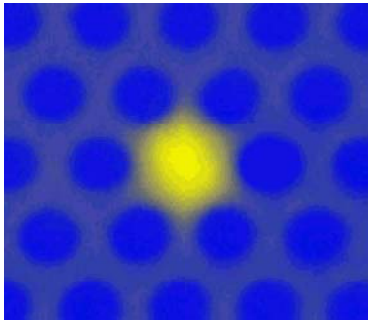
Photonic crystal fibers (PCF) are a new class of optical waveguides in which the properties of the glass combined with a superposed geometrical structure (holes) give tight confinement of the light in a small central region (core) and enhanced optical nonlinearities.

Mode structure of the light coming out of the fiber: these fibers are single mode over a wide range of wavelengths

SEM Image



Mode

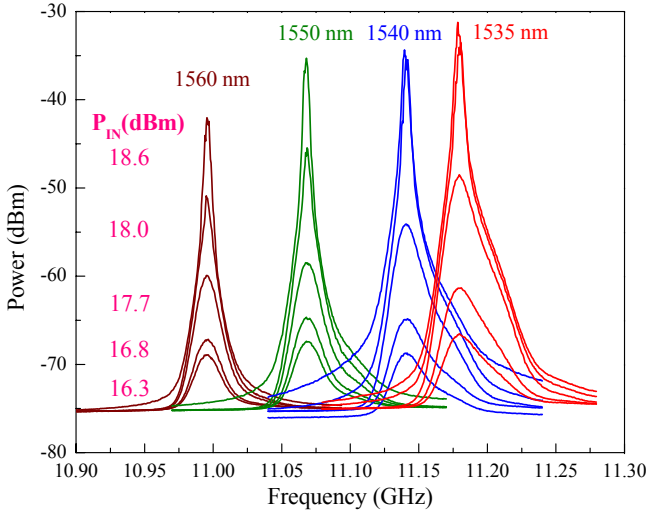


Stimulated Brillouin scattering (SBS)

-The experimental measurements in our fiber optics laboratory reveal a higher SBS threshold power for SBS in PC421 PCF than in conventional fibers, due to scattering of acoustic waves at interfaces (glass-air).

-Partially guided acoustic waves in the stimulated regime give rise to efficient lasing in these fibers.

SBS spectra
(at different wavelengths)

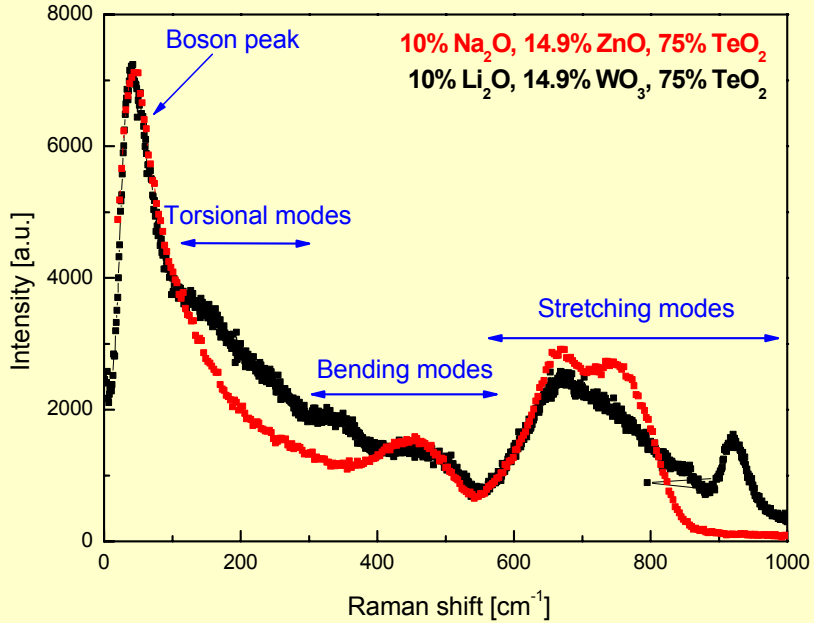


Future

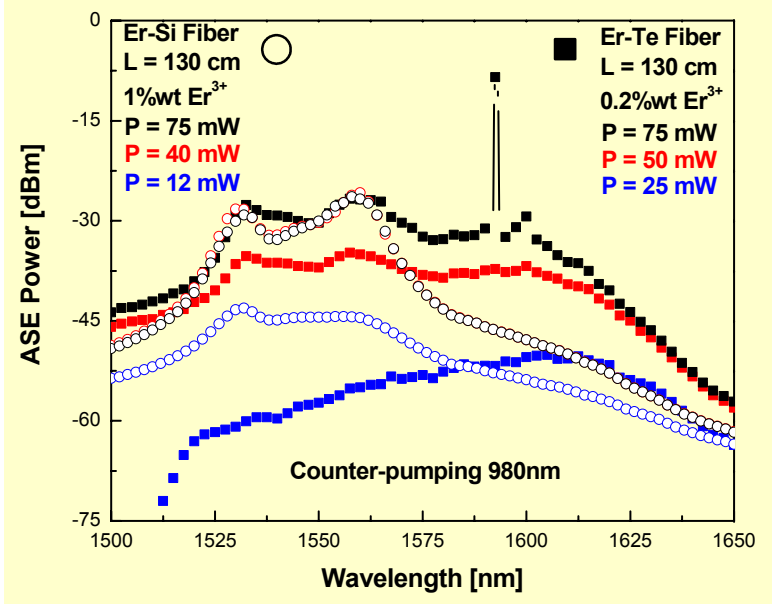
Tune the nonlinear properties of the fiber by changing glass or glass composition or by injecting different gases or liquids in the holes

TELLURITE GLASSES AND FIBERS,

Jean Toulouse, Lehigh University, (DMR-9974031)



Raman spectra of two different tellurite glasses, one with zinc and the other with tungsten



Emission spectra from an Er-doped fiber made of the Na_2O-ZnO-TeO_2 glass compared to an Al-SiO_2 glass for different pump powers

Vibrational Raman spectroscopy was used ***to study the glass structure*** and understand ***how it affects the emission properties.*** Raman spectroscopy not only helps identify the structural units present, based on their high frequency internal vibrational modes, but also provides information relative to the glass network topology based on lower frequency intermolecular or collective modes of several units, such as the torsional modes of a chain (150-350cm^{-1}).

Emission studies reveal ***much broader and flatter spectra*** in erbium-doped (Na,Zn) tellurite-based glasses than in alumina-silica glasses. Signal gains as high as 30dB (a factor of 1000) can be achieved in fibers made of tellurite glass for as short as a1m long fiber as compared with more than 100m in silica fibers. The origin of this effect appears to lie in higher transition efficiencies between Er^{3+} energy levels in the longer wavelength part of the spectrum in tellurite glasses.